Biospheric Sciences Branch Highlights for May - June 2000

** Final Science Meeting of the Ten-Year BOREAS Project

The final science meeting of the Ten-Year **Boreal Ecosystem-Atmosphere Study (BOREAS)** project was held May 15-18 in Victoria B.C at the Pacific Forestry Center. Forty to fifty scientists attended, including Dr. Diane Wickland, BOREAS Program Manager from NASA Hq; Dr. Forrest Hall (Code 923), BOREAS Project Manager, organized and conducted the workshop. The workshop focused on (i) reviewing accomplishments and science results from BOREAS, (ii) reviewing the latest results from intercomparisons and performance characterization of nine carbon cycling and seven hydromet models using a common driver and validation data set developed over the BOREAS region. (iii) Definition of where we need to go from here to model the boreal ecosystem at a global scale and (iv) planning for a third BOREAS JGR Special Issue. Because the boreal ecosystem is such an important contributor to the global carbon cycle, BOREAS findings have particular relevance to NASA's new Carbon Cycle Initiative. Dr. Wickland told the workshop that she was very pleased with the workshop and the results from BOREAS. A few activities remain to complete BOREAS including production of a second CD ROM set containing the model intercomparison data, and publication of a third JGR Special Issue. Accomplishments and Science Results are summarized below.

ACCOMPLISHMENTS

85 paper volume of the JGR Atmospheres BOREAS Special Issue
11 - paper volume of the BOREAS Special Issue of Tree Physiology
9 - paper volume of the Canadian Journal of Remote Sensing.
27 - paper volume of the JGR Atmospheres BOREAS 2nd Special Issue 445 other journal articles
12 - Volume CD ROM capturing BOREAS Data (Netscape Interface)

Rigorous and Detailed Intercomparison and Performance Characterization of Nine Ecosystem Process and Seven Hydrometerological Models

SCIENCE RESULTS

BOREAS research has greatly advanced our understanding of the important roles that the circumpolar boreal ecosystem plays in global carbon dynamics, interannual variations in climate, weather patterns and how to characterize the ecosystem state and carbon, water and energy cycling rates using modeling and remote sensing.

BOREAS has shown land surface-atmosphere interactions in the boreal ecosystem to be as important as the sea surface boundary condition in influencing weather and climate.

BOREAS data have been used extensively to modify operational numerical weather prediction models and greatly improve forecast accuracies.

BOREAS has demonstrated directly that the boreal ecosystem takes in and stores large amounts of carbon, has elucidated the biological storage and release mechanisms, and shown that small changes in climate may lead to large shifts in carbon exchange and atmospheric carbon dioxide concentration.

BOREAS has greatly advanced remote sensing capability in boreal ecosystems by significantly improving land cover algorithms, satellite measurement of atmospheric radiation and snow albedo, improved soil freeze/thaw monitoring using radar, biomass density observation from lidar, and hyperspectral measurement of photosynthetic rates.

BOREAS has defined the crucial next steps needed in order to monitor the boreal ecosystem on a global scale, including what carbon, water and energy cycling processes are the most critical model and monitor, what additional new data sets are required to go global, and what new satellite missions may be necessary.

**** International Boreal Forest Research Association's 2000 Conference**

Three 923 poster papers were presented at the International Boreal Forest Research Association's IBFRA 2000 Conference on "The Role of Boreal Forests and Forestry in the Global Carbon Budget" held in Edmonton, Alberta (May 8-12). Dr. Elizabeth Middleton and Ms. Gloria Rapalee of Code 923 attended. The papers were: "Dependence of Photosynthetic Capacity and Photosynthetic Pigment Allocation on Foliar Nitrogen Levels in Aspen Stands", E.M. Middleton (Code 923), J.H. Sullivan, and A. J. Papagno (Code 923); "Moss Cover at Local and Regional Scales in the Boreal Forests of Canada", G. Rapalee, L.T. Steyaert, and F.G. Hall (all Code 923); and "Man-made and Natural Disturbances along the Siberian IGBP Transect", V.I. Kharuk and J.K. Ranson (Code 923).

**** Scientists and Science Counselor of the United States Embassy in Brazil visit NASA LBA-Ecology Project forest sites**

On June 20, Darrell A. Jenks, Science Counselor for the United States Embassy in Brazil, along with several other scientists including Dr. George Woodwell of the Woods Hole Research Center and Dr. Eric Stoner of US AID, visited two of the NASA LBA-Ecology Project forest sites located south of Santarem in the northern part of the Amazon. He observed measurements being made for a forest `dry-down` experiment and watched scientists and technicians installing new instrumentation being placed at various levels within and above the forest canopy on one of the 65 m tall towers recently constructed for obtaining continuous measurements of CO2 and other biological gases, water and energy within the rain forest. Following the muddy, four-wheel truck drive through the forest, Dr. Donald Deering, Project Manager, hosted Mr. Jenks and others on a tour of the base camp located in the rain forest conveniently close to the study sites. The base camp, which is nearing completion and is expected to be completely occupied in July, includes temporary living quarters for up to 40 people. Here Mr. Jenks participated in a round-table discussion with LBA scientists and representatives from local government and educational institutions and news media.

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**** Press Coverage of the Collection of Airborne Laser Data over Delaware in Support of DDF-funded Research**

Ross Nelson/923 has been collecting airborne laser data over Delaware in support of DDF-funded research: 1) to develop/utilize an inexpensive, portable airborne laser system, and 2) to inventory the State of Delaware using that system. Airborne laser data will be collected statewide along parallel N-S transects 1 km apart; in total, 5000 km of flightline will be flown. Nelson met with reporters from the Delaware State News and from the News Journal June 7 at the Sussex County Airport in Georgetown, Delaware during a refueling stop. These interviews resulted in the following press coverage:

- Delaware State News: front page article, 6/8
- The News Journal (Wilmington, DE): front page article, 6/12
- AP news summary for general distribution: ~6/12
- Easton (MD) Democrat: 6/13
- USA Today: 2 sentence blurb under State News, Delaware, 6/13
- Farm Chronicle: expected 6/21.

Approximately half the State has been surveyed; the remaining flight lines (2800 km) will be flown at the end of June.

**** SAFARI 2000 Data Management Group hosts Information Technology (IT) specialists from southern Africa**

The SAFARI 2000 Data Management Group hosted Information Technology (IT) specialists from southern Africa during the week of June 12 at GSFC, Univ. of VA, and the ORNL DAAC. Participants completed a plan for a distributed data sharing system, capitalizing on existing expertise at GSFC, ORNL, a NASA ESIP Type 2 and the Univ. of Witwatersrand (WITS) in South Africa. GSFC's role will include creating CD-ROMs, procuring "tasked"

imagery such as Landsat 7, and establishing data pipelines for sending EOS imagery to the newly-initiated SAFARI Regional Data Center at WITS. The plan was presented to Michael King, David Starr, and Henry Watermeyer, Head of IT at WITS.

**** Letter of Appreciation from the Landsat Science Team:**

Dr. Darrel Williams, Landsat Project Scientist, recently received a letter of appreciation from Dr. Sam Goward, the Landsat Science Team Leader. Goward wrote the letter on behalf of the entire Landsat Science Team. The letter, although addressed to Williams, was really intended to go to the entire team of people who participated in the build and launch of the very successful Landsat 7 mission. Copies of the letter were also cc'd in hard copy format to the upper management of NASA Headquarters Code Y, NASA Goddard, and USGS Reston and EDC.

The following excerpts were extracted from the body of the letter:

On behalf of the Landsat Science Team I would like to congratulate you and the diverse members of the Landsat Project with your exceptional accomplishments in the development and deployment of Landsat-7 mission. Your leadership in this joint NASA/ USGS mission has implemented a new vision for the Landsat series. Specifically, Landsat has now become a truly global observing mission. Through your efforts, NASA has begun a new era in which high spatial resolution multispectral studies are possible at global scales.

You may wonder why we have waited for over a year since the mission's successful launch on April 15, 1999 to compose this letter. There is no question that the actual launch was also a remarkable success. However, for the Landsat Science Team the real accomplishments of this mission can only be appreciated after our experiences of examining the observations acquired by this exceptional observatory.

As you know, we recently conducted a Science Team meeting at the University of Colorado from May 8-11, 2000. During this meeting we intensively reviewed the performance of the ETM+ instrument and other aspects of the mission, along with early science results produced by the Science Team Members. Among the various highlights we noted:

- The radiometric performance of the ETM+ on Landsat-7 substantially exceeds pre-flight specifications in all wavelengths with little or none of the noise sources found in the observations from Landsats 4 and 5.

- - USGS scientists have developed methods to establish the geographic precision of the observations to better than 50m. This is 5 times better than the original mission specifications of 250m

- - The automated Long-Term Acquisition Plan to create a US-held archive of global observations is succeeding beyond our expectations. Already over 70,000 scenes have been accumulated in the archive, covering all land areas of the planet. Better than 90% of this land area has been observed at least once with less than 10% cloud cover (in less than one year!).

- - The USGS EROS Data Center is providing data access within 24-48 hours after acquisition. Over 60 scenes a day are now being purchased from this archive (as well as observations provided by international ground stations).

We are now on the verge of realizing the long-held dream of Landsat as the observatory that permits us to understand the land component of the Earth system, specifically the role of human activities both as a source and sink for global change. We would not now be in this exceptional position of discovery if it were not for the heart-felt dedication of all members of the NASA and USGS Landsat Team.

The Landsat Science Team congratulates you and applauds you on this success. Your long-term commitment to the Landsat mission has reaped rewards far beyond our expectations if not beyond our greatest dreams.

**** Landsat-7 ETM+ Calibration Workshop**

A one day ETM+ calibration workshop was conducted May 8 in Boulder, Co. in advance of the May 9-11 science team meeting. Presentations were made by Code 923 Landsat Science Office personnel (B. Markham, J. Barker and J. Storey/EDC) and Science Team personnel (K. Thome/ UAZ, D. Helder/SDSU, S. Andrefouet/USF, F. Palluconi/JPL and J. Schott/RIT) on results from the on-board calibrators and vicarious calibration experiments. For both the reflective and thermal bands, results indicated that the ETM+ was extremely stable in its radiometric response. A comparison of reflective band calibration results showed no definitive trends in the response of the ETM+ since launch and no definitive indications of bias errors in the pre-launch calibration currently being used for processing of Landsat-7 ETM+ data. Results from the various calibration methods were generally within the stated error bars, typically ±5%. The currently used calibration will continue to be used except for refinements based on the Landsat Transfer Radiometer (LXR) results, refinements to the ETM+ high-to-low gain ratio and in-band relative detector to detector gains. The thermal band showed changes of less than 0.5% over time based on its internal calibration system. Comparison's to two

independent ground based vicarious calibration results did indicate a consistent ~0.3 W/m2 sr μm bias, with the ETM+ calibration indicating higher radiance than the ground measurements. This bias error corresponds to about 3°C at typical earth surface temperatures. The intention is to inform the user community of this bias error and work several strategies to remove the bias error from the data.

**** New Subgroup of the Committee on Earth Observing Satellites' (CEOS) Working Group on Calibration and Validation (WGCV)**

A new subgroup of the Committee on Earth Observing Satellites' (CEOS) Working Group on Calibration and Validation (WGCV) convened at the Joint Research Center in Ispra, Italy on May 23-25, 2000. The Land Product Validation (LPV) Subgroup is dedicated to defining and promoting the "best practice" methods in validating Level 2+ land products, such as leaf area index, land cover type, burn scar and albedo. The initial workshop was focused on moderate resolution satellite products in association with the Global Observation of Forest Cover (GOFC) program. Break-out groups addressed the techniques and outstanding issues for validating land cover classification, fire and biosphysical parameter products. Initial Subgroup activities will include LAI and fire product inter-comparisons, development of an international test site list, and topical meetings on key products and validation issues. Jeff Privette (Code 923) was nominated as the Subgroup Co-Chair, while Jeff Morisette (UMd/GSFC) was nominated as Deputy Co-Chair. The enthusiastic international response to this initial meeting suggests that urgent coordination is needed before additional major satellite platforms (e.g., ADEOS II, ENVISAT, SAC-C) join EOS Terra in orbit. The next LPV Subgroup meeting will be held in conjunction with the Infrared and Visible Optical Sensors (IVOS) Subgroup meeting in mid-October, 2000.

More information on CEOS WGCV can be found at: http://wgcv.ceos.org

**** Second EO-1 Science Validation Team (SVT) Meeting**

The second EO-1 Science Validation Team (SVT) Meeting was hosted by EROS Data Center (EDC) in Sioux Falls, SD from June 8 through June 10. The meeting was very well attended (approximately 60 participants) considering numerous conflicting activities during that time period. Substantial progress was made toward achieving the meeting's primary objective of devising an integrated (SVT and Instrument Teams) Long Term Acquisition Plan (LTAP) to facilitate the EO-1 mission's validation objectives. The next EO-1 SVT meeting is planned to coincide with the EO-1 launch at VAFB in mid October. URL: http://eo1.gsfc.nasa.gov/

EDUCATION HIGHLIGHTS

**Darrel Williams Delivers Commencement Speech at His Alma Mater

Dr. Darrel Williams, Head of the Biospheric Sciences Branch, Code 923, was invited to return to his high school alma mater to deliver the commencement address at the graduation ceremonies for the Punxsutawney Area High School (PAHS) Class of 2000 on June 9. Williams had graduated from PAHS in 1969. The speech, which was also carried on local cable TV, was well received by the 205 graduating students and an audience of ~1200 who were in attendance. A few of the points that Williams tried to make were as follows:

(1) The formula for getting ahead in life doesn't rely on luck, nor can all knowledge be gained by simply reading books or sitting in a classroom. Everybody is presented with opportunities from time to time, and those who may outwardly seem to be lucky are really those who have worked hard, both academically and by gaining practical "hands-on" experience, to prepare themselves to take advantage of opportunities when they do arise."

(2) "It doesn't matter about the size of your school or community you come from, rather it's the size of your heart, your desire and your preparation that counts."

(3) "Never become too comfortable or confident, to a point where you give less than 100% at all times. Remember that there is usually somebody just as good, or better, waiting in the wings to step in when you let up."

(4) Ask yourself when confronted with a situation, "What is the right thing to do? We all have the responsibility to do the right thing."

** Code 923 participates in NASA Educator Workshop (NEW)

The NASA Educator Workshop for teachers of grades 5-12 (NEW 5-12) kicked off this week as 25 teachers from Indiana, Maryland, New York, Virginia, Connecticut, Iowa, Massachusetts, Pennsylvania, Rhode Island, Kentucky, Ohio, Florida and West Virginia spent the first week of their two-week session at Goddard learning about the Center's work in remote sensing science and technology.

Darrel Williams gave an opening presentation on Landsat data and applications followed by Sietse Los who presented an introduction to remote

sensing. Frank Niepold, who provides Landsat Project Science Office (LPSO) education support for the Branch, conducted a workshop for the teachers which focused on imaged processing of Landsat data using Multispec software (freeware). He also discussed Landsat data availability, which is one of the main difficulties teachers face in using this data.

During the summer, each NASA center will play host to a group of 25 teachers from across the country. The NEW 5-12 program models the integration of the national science standards in mathematics, science and technology. The focus for this year's GSFC group is remote sensing science and technologies. The educators will observe NASA's state-of-the-art research and development through direct interaction with NASA scientists, engineers, technicians and educational specialists. "We hope that through this intense two-week program, the teachers can increase their knowledge of the science and technology involved in performing remote sensing and apply this in their work with students," said Dr. Robert Gabrys, Education chief in the Public Affairs Office at Goddard.